

Review Article

A COMPREHENSIVE REVIEW ON ARTICAININE

Dr. Parimala Kulkarni¹

¹Professor and Dean, Peoples College of Dental Sciences and Research centre, Peoples University, Bhopal, drptyagi@gmail.com

Abstract:

Local anaesthetics (LAs) offer patients pain-free dental care while lowering patient apprehension and anxiety. Evidence-based dental clinical practice should be based on the most recent clinical studies and involve ongoing reevaluation of all available clinical data on the efficacy and safety of dental anaesthetics. When dealing with children, it is imperative to understand the overdosage of anesthetic agents resulting in toxic reactions and soft tissue trauma inflicted due to extended spans of anesthesia and variations of technique. The anaesthesia should have minimal side effects and optimal efficacy with the fewest injections possible. Hence, this review has been undertaken to assess the various parameters related to Articaine, the newer anesthetic.

Key-words: Articaine, Anesthetic, Children, Dentist, Vasoconstrictor

1. Introduction

Local anaesthesia is the transient lack of sensation, inclusive of pain, in one area of the body caused by a substance that is applied topically or administered intravenously without impairing consciousness. The fast ionic influx of sodium required for the formation of neuronal impulses is inhibited by local anaesthetics within the neural fibres.^{1,2} This serves to reduce the transmission of pain sensations during treatments, which can serve to improve patient-doctor interaction, assuage fear and anxiety, and encourage a positive attitude toward dental care. In order to guide the behaviour of paediatric patients, the local anaesthetic delivery approach must be taken into account.³ Children can experience a pleasant local anesthetic session with the use of appropriate technique, injection, and pharmacological management.⁴

Pain management is one of the most important factors in determining the outcome of dental treatment and influencing the child's attitude toward dental visits in the future. The construction of a successful and efficient paediatric treatment triangle depends on the effective and complete removal of pain across the dental setting.⁵ The efficacy and safety of any local anaesthetic medication are the two most important requirements.⁶ The amide group substance lidocaine was first developed in the middle of the previous century. Due to its effective operation and dearth of adverse side effects, lidocaine became widely known around the world and was regarded as the "gold standard" for comparison with later developed local anaesthetic agents.⁷

2. Review

2.1 Introduction of a new anesthetic agent- Articaine:

Articaine hydrochloride made its debut as a new local anaesthetic agent in 1969. The chemical structure of articaine differs from other local anaesthetics in that it contains a thiophene ring rather than the typical benzene ring, which boosts articaine's lipophilicity and hence its efficacy. The presence of the ester group is the other unique trait. These unique qualities enable rapid articaine hydrolysis in the blood and reduce the possibility of systemic toxicity. Articaine is 1.5 times more strong and 0.6 times less poisonous than lidocaine.

2.2 Articaine - Uniqueness

Articaine hydrochloride categorises as a local analgesia of amide type. It works similarly to other amide analgesics, but because of its special chemical makeup, which includes a thiophene ring, it is more effective and penetrates both hard and soft tissue. Additionally, the ester group that is present in articaine allows it to be quickly converted into its inactive state, reducing systemic toxicity. Articaine is produced as a 4 percent solution in 2.2 ml and 1.7 ml glass dental cartridges with a 1:100,000 or 1:200,000 adrenaline concentration. Both doses cause analgesia to start acting quickly, with a similar amount of pulpal (lasting about an hour) and soft tissue analgesia (3-5 hours)

2.3 Effectiveness of Articaine in Children:

Pain management is one of the most important factors in determining the outcome of dental treatment and influencing the child's attitude toward dental visits in the future. The construction of a successful and efficient paediatric treatment triangle depends on the effective and complete removal of pain across the dental setting. The two most important requirements for any local anaesthetic medication are efficacy and safety. The amide group substance lidocaine was first developed in the middle of the previous century. Due to its effective operation and dearth of adverse side effects, lidocaine became widely known around the world and was regarded as the "gold standard" for comparison with later developed local anaesthetic agents.

Articaine is the only amide analgesic with an ester group and has a high affinity for binding plasma proteins. This makes it possible for it to be quickly converted into its inactive state in the blood serum and the liver, reducing systemic toxicity. The biotransformation of articaine takes place both in the liver and plasma, as opposed to other amide local anaesthetics that solely go through metabolism in the liver.

2.4 Factors Affecting Articaine: ⁸

Vasodilators: All local anaesthetics used nowadays in dentistry via injection are vasodilators. Due to this, the clinical anaesthetic lasts for a shorter period of time and the local anaesthetic level in the blood increases, both of which are undesired outcomes.

Concentration: The amount of milligrammes per millilitre of solution and the amount of drug circulating in the patient's circulation increase with increasing local anaesthetic concentration (percent solution injected). For instance, 72 mg of the medication are present in 1.8 mL of a 4 percent solution, whereas only 36 mg are present in 1.8 mL of a 2 percent solution.

Dose: The higher the circulating blood level that results from administering a local anaesthetic in a larger volume and more milligrammes per injection.

Administration Method: Local anaesthetics have clinical effects where they are deposited. An accidental intravascular injection contributes to local anaesthetic overdose in dentistry. In a short amount of time, extremely high drug levels can be attained, which can result in severe overdose reactions. Because some topically administered anaesthetics enter the circulatory system quickly, oral mucous membrane absorption of local anaesthetics has the potential to be harmful.

Rate of Injection: An essential determinant in the development or absence of overdose reactions is the rate at which a substance is injected. One cartridge of lidocaine administered quickly (15 seconds or less) results in significantly raised levels and practically guarantees an overdose reaction. Slow delivery (60 seconds or more) results in much lower blood levels and a lower likelihood of a serious overdose reaction. The mouth is one of the most highly vascular regions of the entire body, and the greater the vascularity of the injection location, the quicker the medicine will be absorbed from that area into the circulation.

Vasoconstrictors: Vasoconstrictors are added to local anaesthetics to constrict blood arteries in the location of injection, slowing the rate of systemic drug absorption and lowering the risk of toxicity while extending the duration of the anaesthetic activity in the area. By using a precise injection method, keeping a close eye on the patient, and being aware of the maximum dosage depending on weight and age, L.A. toxicity can be avoided. Practitioners should inhale deeply and deliberately before each injection. A companion should stay with the patient after the injection while the anaesthesia starts to work. The administration of the local anaesthetic agent should be stopped when toxic signs or symptoms are noticed, and further emergency management should be dependent on the response. Articaine in pediatric dentistry.⁹

Dental professionals working in paediatric dentistry should be aware of the right dosage depending on patient weight and age while administering articaine to reduce the risk of toxicity and prolonged anaesthesia, which can result in unintentional injury to the lip, tongue, or soft tissue. When trying to control pain in younger individuals, it is not required to administer significant amounts of local anaesthetic. Due to differences in anatomy, lesser doses of local anaesthetics can usually provide the depth and duration of pain control needed for younger patients to effectively finish their scheduled dental procedure.

According to reports, articaine 4 percent 1:100,000 is a well-tolerated, secure, and efficient local anaesthetic for usage in children. Due to articaine's 1.5 times greater potency than lidocaine, administration requires less solution volume but a higher drug concentration. The unpleasantness of administering anaesthesia may be lessened by this smaller volume, especially when children's participation is insufficient.

For children, dose should be regulated on a mg/kg basis, as with all medications. Age affects how articaine is metabolised, and as people get older, their clearance and distribution volume decline. It has been observed that there is no need to fix a lower mg/kg articaine dose limit for children due to these age-related changes in pharmacokinetics.

Although some writers have argued for a lower limit of 5mg/kg for children aged 4- 12 years, especially if used in conjunction with sedative drugs, the current paediatric dose recommendation for articaine is 7mg/kg in children aged 4 years and beyond. In any case, even though lesser doses of articaine can be provided, it must be kept in mind that its concentration is double that of lidocaine, necessitating a halving of the safe number of cartridges. If dentists don't exercise caution when treating children, this maximum dosage could quickly be exceeded.

3. Comparison of Articaine and Lignocaine

For the extraction of the mandibular posterior teeth, a comparison of mandibular block anaesthesia with 2 and 4 percent articaine shows that both concentrations provide adequate anaesthesia with no discernible differences, with the exception that 2 percent articaine produces shorter soft tissue anaesthesia. Due to its shorter serum half-life and lower maximum blood concentration, two percent articaine may be helpful for kids.¹⁰

Wright et al 1989's retrospective research, which examined 211 paedodontic cases involving articaine, provided evidence of the safety of its usage in children under the age of four. Since no negative effects were noticed, the evaluation concluded that articaine is safe to use in children under the age of 4.¹¹ In a comprehensive assessment of articaine published in 2011, the drug was deemed to be safe and effective for use in children of all ages.¹² A further 2018 study discovered that there is no difference in the frequency of anaesthetic-related adverse effects in children between articaine and lidocaine.¹³

4. Conclusion

Even though articaine is a safe and efficient local anaesthetic that has several benefits for treating children's dental pain, its manufacturers do not advise using it on young children younger than 4 years old. The possibility that infiltration approach could replace IANB is what deserves the most attention. Although the duration of a soft tissue anaesthetic may be extended, the risk of other unfavourable effects is comparable to that of other local anaesthetics. Each child's articaine dosage needs to be calculated because it is necessary to use less of the more potent local anaesthetic solutions than lidocaine. While avoiding block and palatal anaesthetic for paediatric dental treatment, practitioners should be aware of the effectiveness of articaine to diffuse into bone and soft tissue to deliver great depth of anaesthesia.

References

- ¹Ogle OE, Mahjoubi G. Local anesthesia: agents, techniques, and complications. *Dent Clin North Am.* 2012;56(1):133-48. doi: 10.1016/j.cden.2011.08.003, PMID 22117947.
- ²Malamed SF. Neurophysiology. In: *Handbook of local anesthesia*. 7th ed. St. Louis: Mosby; 2020. p. 2-26.
- ³Jones JE, Dean JA. Local anesthesia and pain control for the child and adolescent. In: Dean JA, editor *McDonald and Avery's dentistry for the child and adolescent*. 10th ed. St. Louis: Mosby; 2016. p. 274-85.
- ⁴Malamed SF. Basic injection technique. In: *Handbook of local anesthesia*. 7th ed. St. Louis: Mosby; 2020. p. 173-85.
- ⁵Bagattoni S, D'Alessandro G, Gatto MR, Piana G. Self-induced soft-tissue injuries following dental anesthesia in children with and without intellectual disability. A prospective study. *Eur Arch Paediatr Dent.* 2020;21(5):617-22. doi: 10.1007/s40368-019-00506-9, PMID 31898299.
- ⁶Boonsiriseth K, Chaimanakarn S, Chewprecha P, et al. 4% lidocaine versus 4% articaine for inferior alveolar nerve block in impacted lower third molar surgery. *J Dent. Anesthesiol Pain Med.* 2017;17(1):29-35. 3.
- ⁷Alzahrani F, Duggal MS, Munyombwe T, Tahmassebi JF. Anaesthetic efficacy of 4% articaine and 2% lidocaine for extraction and pulpotomy of mandibular primary molars: an equivalence parallel prospective randomized controlled trial. *Int J Paediatr Dent.* 2018;28(3):335-44. doi: 10.1111/ipd.12361, PMID 29573375.
- ⁸Elheeny AAH. Articaine efficacy and safety in young children below the age of four years: an equivalent parallel randomized control trial. *Int J Paediatr Dent.* 2020;00:1-9.
- ⁹Guideline on use of L.A. for pediatric dental patients – Reference manual V38/No6 16/17 – Review Council on Clinical Affairs, 2015.
- ¹⁰Kämmerer PW, Schneider D, Palarie V, Schiegnitz E, Daubländer M. Comparison of anesthetic efficacy of 2 and 4% articaine in inferior alveolar nerve block for tooth extraction-a double-blinded randomized clinical trial. *Clin Oral Investig.* 2017;21(1):397-403. doi: 10.1007/s00784-016-1804-5, PMID 27020911.
- ¹¹Wright GZ, Weinberger SJ, Friedman CS, Plotzke OB. Use of articaine local anesthesia in children under 4 years of age—a retrospective report. *Anesth Prog.* 1989;36(6):268-71. PMID 2490059.
- ¹²Yapp KE, Hopcraft MS, Parashos P. Articaine: a review of the literature. *Br Dent J.* 2011;210(7):323-9. doi: 10.1038/sj.bdj.2011.240.
- ¹³Tong HJ, Alzahrani FS, Sim YF, Tahmassebi JF, Duggal M. Anaesthetic efficacy of articaine versus lidocaine in children's dentistry: a systematic review and meta-analysis. *Int J Paediatr Dent.* 2018;28(4):347-60. doi: 10.1111/ipd.12363, PMID 29635712.